

REMARKS

Claims 1-5, 9-15, 17-21, and 23-25 are pending in the application. Claims 1, 9-11, 15, 17 and 21 have been amended. No new matter has been introduced. Claims 6-8, 16 and 22 have been canceled. In view of the foregoing amendments and the following remarks, Applicants respectfully request allowance of the application.

CLAIM OBJECTIONS

Claim 17 is objected to for the use of the terms “bfst” and “vbfst.” Applicants note that these terms are well defined within claim 17 and are consistent with the terminology used in independent claim 16 from which claim 17 depends. Therefore, the meaning of these terms are clear and do not need to be spelled out for clarification.

PRIOR ART REJECTIONS

Claims 1-2 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Pat. No. 6,862,402 to Kim.

Claims 3-5 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kim in view of Ma et al., “Rate Control for Advance Video Coding (AVC) Standard.”

Claims 6-11 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kim in view of U.S. Pat. No. 5,598,213 to Chung et al.

Claims 12-14 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kim in view of Chung et al. and further in view of Ma et al.

Claims 15, 18, 21 and 23 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Chung et al.

Claims 16 and 17 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Chung et al. in view of U.S. Pat. No. 6,900,829 to Ozawa et al.

Claims 19, 20, 24 and 25 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kim in view of Chung et al. in view of ITU-T H.264 Series H: Audiovisual and Multimedia Systems Infrastructure of Audiovisual Services.

Claim 22 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Chung et al. in view of U.S. Pat. No. 7,266,148 to Kim.

Claims 1-5 and 9-10 Define over Kim and Chung et al.

Amended independent claim 1 recites, *inter alia*,:

wherein the buffer based quantizer computer generates its quantizer estimate from a comparison of the fullness indicator to a virtual fullness calculation based on target bit rate calculations and actual bit rates of prior frames,
 wherein the buffer based quantizer computer comprises:
 a virtual buffer fullness computer, including storage for target bitrate values, actual bitrate values and picture type assignments of prior coded pictures,
 a comparator having inputs for the fullness indicator and an output of the virtual buffer fullness computer, and
 quantizer mapper having an input for an output of the comparator and an output for the quantizer estimate,
 wherein the comparator is a weighted comparator, having an input for a weighting value that determines a relative value adjustment between the fullness indicator and an output of the virtual buffer fullness computer, wherein the weighting value is set according to an application for which the video coder is to be used.

Neither Kim nor Chung et al., either alone or in combination, teach or suggest at least the above-highlighted features of independent claim 1.

In an aspect of the present invention, a buffer based quantizer computer can generate a quantization estimation based on a comparison of a virtual transmit buffer fullness indicator and an actual transmit buffer fullness indicator. The actual transmit buffer fullness indicator may represent an amount of coded video data that is queued for transmission out of a video coder. The virtual transmit buffer fullness indicator may be calculated from target bit rate identifiers and actual bit rate identifiers of past frames. The buffer based quantizer computer can comprises a weighted comparator and a quantizer mapper. The weighted comparator can determine a relative value adjustment between the actual and virtual buffer fullness indicators. The relative value adjustment, or weighing variable, can be adjusted based on the application for which the video coder is being used. The output of the weighted comparator is used by the quantization mapper to produce the quantization estimate. (See paragraphs 112-116 and corresponding Figure 16)

Applicants contend, contrary to the Office Action's allegation on page 5, that Chung et al. fails to teach or disclose generating a quantization estimate based on a weighted comparison of a fullness indicator from a transmit buffer of a video coder and a virtual fullness indicator as recited in claim 1. Figure 3 of Chung et al. clearly shows that Reference Quantization

Coefficient Calculator 31' generates a reference quantization coefficient Q_j based on buffer fullness value d_j . Col. 4, lines 35-53 of Chung et al. describes the calculation of Q_j as being based on an unadjusted buffer fullness value:

35 Meanwhile, a reference quantization coefficient Q_j can be obtained by the following equation 4:

$$Q_j = k_n \left(\frac{31d_j}{\gamma} \right) \quad (4)$$

40 where d_j is the buffer fullness reaching the j 'th quantization updating unit of the current frame, γ is buffer size, the numerical value 31 is a system constant, and K_n is the rate control adjustment coefficient of the n 'th segment of the previous frame. At this time, in order to minimize the buffer
45 instability due to the adjustment coefficient, the coefficient K_n is limited; that is, the adjustment coefficient is set to an upper limit critical value TH1 for $K_n > TH_1$ and is set to a lower limit critical value TH2 for $K_n < TH_2$. As understood from the above equation 4, the reference quantization coef-
50 ficient is determined by the buffer fullness d_j conventionally, but, in the present invention, is determined by the adjustment coefficient K_n in consideration of the local characteristics of a picture as well as the buffer fullness value d_j .

This is reiterated at col. 5, lines 42-54 of Chung et al. which also recites the precise calculations necessary to generate the quantization estimate:

Reference quantization coefficient calculator 31' receives the buffer fullness value d_j from encoder buffer 2, receives the adjustment coefficient K_n from memory 35, and calculates a reference quantization coefficient Q_j . 45

Activity calculator 32 receives the output of data formatter 10, calculates the activity of the current frame in the unit of a macroblock, multiplies the calculated activity value with the reference quantization coefficient Q_j to calculate a new quantization coefficient Q'_j , and outputs the product to 50 quantizer 40. Therefore, quantizer 40 adjusts the quantization step size so that the output of VLC 50 becomes close to the quantity of target bits depending on the output Q'_j of activity calculator 32.

Chung et al. states the buffer fullness value is determined conventionally by calculating a target bit quantity for each slice and then updating it "by the difference in generated bit quantity with respect thereto, for the actual slices" (col. 3, lines 44-45; col. 4, lines 48-50). As such, Chung et

al. follows a conventional method for generating a buffer fullness value that involves using only unadjusted target bit rates and actual bit rates and, more particularly, does not use weighted actual and virtual buffer fullness indicators. Therefore, the buffer fullness estimate of Chung et al. is not generated using a “weighting value that determines a relative value adjustment between the fullness indicator and an output of the virtual buffer fullness computer” as recited in claim 1.

Applicants further contend that because Chung et al. fails to disclose a weighted comparison of an actual buffer fullness indicator and a virtual buffer fullness value to arrive at a fullness indicator, then Chung et al. necessarily cannot teach or suggest that the weighting factor used “is set according to an application for which the video coder is to be used,” as recited in claim 1.

Lastly, Applicants contend that Chung et al. fails to teach or disclose a “quantizer mapper having an input for an output of the [weighted] comparator and an output for the quantizer estimate” as recited in claim 1. Fig. 3 of Chung et al., in conjunction with col. 5, lines 42-54 recited above describes the exact mathematical calculations required for generating a quantization estimate. This section, as well as the remaining sections of Chung et al., fails to teach or disclose a mapper having an input received from a weighted comparator and output that produces a quantization estimate from a look-up table as recited in claim 1.

For at least these reasons, Applicants believe that the rejection of claim 1 should be reconsidered and withdrawn. Claims 2-5 and 9-10 depend from independent claim 1 and are allowable for at least the reasons applicable to claim 1, as well as due to the features recited therein.

Claims 11-14 Define over Kim and Chung et al.

Amended independent claim 11 recites, *inter alia*,:

generating a buffer fullness indicator by weighting a comparison of an actual buffer fullness value to the virtual buffer fullness value, wherein the comparison is weighted by a variable w set according to an application for which the new picture is being coded

Neither Kim nor Chung et al., either alone or in combination, teach or suggest at least the above-highlighted features of independent claim 11 for at least those reasons discussed above in conjunction with claim 1. Specifically, neither Kim nor Chung et al. teach or suggest generating a buffer fullness indicator based on a weighted comparison of an actual buffer

fullness value and a virtual buffer fullness value using a weighting variable set according to a coding application as recited in claim 11.

Accordingly, Applicants believe that the rejection of claim 11 should be reconsidered and withdrawn. Claims 11-14 depend from independent claim 11 and are allowable for at least the reasons applicable to claim 11, as well as due to the features recited therein.

Claims 15 and 17-20 Define over Chung et al. and Ozawa et al.

Amended independent claim 15 recites, *inter alia*,:

wherein the comparison of buffer indicators comprises:
multiplying the virtual transmit buffer fullness indicator by a first weighting factor,
multiplying the actual transmit buffer fullness indicator by a second weighting factor, and
generating an overall fullness indicator representing a comparison of the weighted transmit buffer indicators,
wherein the first weighting factor and the second weighting factor are set according to a particular video coding application.

Neither Chung et al. nor Ozawa et al., either alone or in combination, teach or suggest at least the above-highlighted features of independent claim 15.

Contrary to the assertion made by the Office Action on page 8, Chung et al. fails to teach or disclose “generating an overall fullness indicator representing a comparison of the weighted transmit buffer indicators” – i.e., a weighted virtual transmit buffer fullness and a weighted actual transmit buffer fullness indicator – as recited in claim 15. As discussed above, Chung et al. teaches a conventional method of generating a buffer fullness indicator that does not use a comparison of weighted actual and virtual buffer fullness indicators.

Additionally, neither Chung et al. nor Ozawa et al. teach or suggest setting a weighting factor or weighting factors “according to a particular video coding application” as recited in claim 15. Chung et al. fails to disclose weighting at all, or a comparison of actual and virtual buffer fullness levels and so necessarily cannot disclose setting a weighting value or values based on a particular coding application. Ozawa et al. is not directed to video coding or the comparison of buffer fullness indicator levels and so also fails to disclose setting a weighting value or values based on a particular coding application.

Lastly, Applicants contend that a person having ordinary skill in the art would not have reason to combine the teachings of Chung et al. and Ozawa et al. in the manner suggested by the Office Action on pages 9-10 to arrive at the claimed invention.

First, Ozawa et al. is directed to a field of endeavor that is separate and distinct from that of Chung et al. Chung et al. is directed to a method for controlling bit rates during video encoding operations based on the complexity of video data frames. Ozawa et al., on the other hand, is directed to reducing random noise in a video display system. That is, Ozawa et al. is in no way related to video coding or, more specifically, to adjusting bit rates based on complexity estimations of received video signals. Likewise, Chung et al. is in no way related to the reduction of random noise in a video display system. Therefore one having ordinary skill in the art would not look to Ozawa et al. to supplement the teachings of Chung et al. as Ozawa et al. is directed to an entirely separate field of endeavor that does not attempt to solve a problem that is the focus of Chung et al.

Second, Chung et al. fails to teach or disclose the use of actual and virtual buffer fullness indicators and instead relies on a conventional method of generating a singular, buffer fullness value that is not compared to any other buffer fullness value. Therefore, a person having ordinary skill in the art would not be motivated to combine the disclosure of weighted comparisons of Ozawa et al. with Chung et al. since Chung et al. fails to teach or disclose any two indicators or values that can be compared. The focus of Chun et al. is adjusting a quantization estimate based on a rate control adjustment K_n (see col. 4, lines 48-53), not providing an improved buffer fullness indicator as is a focus of the present claimed invention.

Third, the alleged results of combining Chung et al. and Ozawa et al. stated by the Office Action on page 10 are illogical. The Office Action alleges that the combination would “reduce reproduction and coding error.” Neither of these stated goals are goals of Chung et al. Chung et al., as described above, is directed to varying coding rates to account for the complexity of video frames to be coded and the amount of coded bits generated already for prior coded video frames. Chung et al. is not directed to coding error or the reduction of reproduction caused by random noise by improved rate control. Further, Chung et al. is not directed to reducing reproduction. Chung et al. is instead directed to choosing the best quantization estimate given the current estimate of a buffer fullness and the complexity of video frames to be coded to achieve a target bit rate. Chung et al. is not concerned with reducing errors in the coded signal caused by random noise. Therefore, it is clear that Chung et al. and Ozawa et al. are directed

to separate and distinct problems that have nothing more in common than being related to video signals.

Accordingly, in the view of the foregoing, Applicants believe that the rejection of claim 15 should be reconsidered and withdrawn. Claims 17-20 depend from independent claim 15 and are allowable for at least the reasons applicable to claim 15, as well as due to the features recited therein.

Claims 21 and 23-25 Define over Chung et al. and Kim (U.S. Pat. No. 7,266,148)

Amended independent claim 21 recites:

A quantizer selection method, comprising:
calculating a normalized average activity level of a picture from on image information of the picture,
adjusting a base quantizer value according to the picture's normalized average activity level, and
selecting a quantizer value for the picture based on the adjusted quantizer value,
wherein the calculating comprises:
for a plurality of macroblocks in the picture,
calculating variances of image data for a plurality of blocks therein,
from minimum variance levels of the macroblocks,
calculating minimum activity levels of the macroblocks, wherein the minimum activity of each macroblock is calculated as:
$$actmin = 1 + \min(blkvar1, blkvar2, blkvar3, blkvar4),$$
 where blkvar represents the variances of 8x8 blocks within a respective macroblock, and
normalizing the minimum activity levels of the macroblocks, wherein the normalized minimum activity per macroblock is calculated as:
$$actnorm = \frac{(2 \times actmin) + actminavg}{actmin + (2 \times actminavg)}$$

where actminavg is a sum of actmin values for all macroblocks in a previously processed picture and the actnorm values for all macroblocks in the picture are averaged to obtain the normalized average activity level of the picture.

Claim 21 has been amended to more fully describe the calculations that may be employed to determine the normalized average activity level of a picture for use in adjusting a base quantizer value. Applicants contend that neither Chung et al. nor Kim, either alone or in combination, teach or suggest the precise normalized average activity level calculations for a picture as recited in claim 21. Accordingly, Applicants believe that the rejection of claim 21 should be

reconsidered and withdrawn. Claims 23-25 depend from independent claim 21 and are allowable for at least the reasons applicable to claim 21, as well as due to the features recited therein.

REQUEST FOR INTERVIEW

Prior to issuance of a subsequent Office Action in the present application, Applicants request a telephone interview be conducted between Applicants' representative Wesley Jones and the Examiner assigned to this application in order to advance prosecution. Applicants respectfully request the Examiner to contact Applicants' undersigned representative at the number provided below to arrange the interview based on the Examiner's availability and prior to the Examiner taking further action in this application.

CONCLUSION

In view of the above amendments and arguments, it is believed that the above-identified application is in condition for allowance, and notice to that effect is respectfully requested. Should the Examiner have any questions, the Examiner is encouraged to contact the undersigned at (202) 220-4419.

The Commissioner is authorized to charge any fees or credit any overpayments which may be incurred in connection with this paper under 37 C.F.R. §§ 1.16 or 1.17 to Deposit Account No. 11-0600.

Respectfully submitted,

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